

REMARKS/ARGUMENTS

The Examiner is thanked for the indication of the allowability of claim 2 if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Amendments

Claim 1 has been amended to include the limitations of claim 2, which was indicated to contain allowable subject matter. In view of the incorporation of the subject matter of claim 2 into claim 1, claim 2 has been canceled.

Claim 3 has been amended to make it dependent on claim 1 in view of the cancellation of claim 2.

Claim Rejections - 35 U.S.C. § 103

The rejection of claims 1, 3-4 and 6-11 under 35 U.S.C. § 103 (a) as being unpatentable over Buisman (US 5,354,545) in view of Fernandez de la Vega et al (US 5,659,109) and LaFoy (US 4,562,300), evidenced by Nakanishi et al (US 5,087,195) is respectfully traversed.

Claims 1, 3-8 and 11

The rejection of claim 1 as unpatentable over the aforementioned references is believed obviated by the amendment incorporating the limitations of claim 2, which was indicated to contain allowable subject matter, into claim 1. Amended claim 1 is in effect claim 2 rewritten in independent form including all the limitations of the base claim and any intervening claims, and as such should be allowable.

Since claims 3-8 and 11 are all directly or indirectly dependent on amended claim 1, and therefore contain all of the limitations of amended claim 1, these claims should likewise be allowable.

Claims 9 and 10

Independent claim 9 claims a gas treating unit for the removal of H₂S and mercaptans from a gaseous hydrocarbon stream comprising *inter alia* at least two gas scrubbers for contacting the gaseous hydrocarbon stream with an aqueous alkaline washing liquid. As discussed below neither Buisman, De la Vega or LaFoy, alone of or in combination, teach or

suggest a gas treating unit comprising at least two gas scrubbers for contacting a gaseous hydrocarbon stream containing H₂S and mercaptans with an aqueous alkaline washing liquid.

The Buisman Reference

While Buisman is concerned with removing H₂S and mercaptans from a gaseous effluent, such removal is accomplished in one step using a single gas scrubber (gas scrubber 2 in Fig. 1). Thus, Buisman does not teach or suggest the apparatus recited in present claim 9 which requires at least two gas scrubbers for contacting a gaseous hydrocarbon stream containing H₂S and mercaptans with an aqueous alkaline washing liquid.

The De la Vega et al Reference

De la Vega discloses a process for liquefying natural gas containing mercaptans in which the mercaptans are concentrated into a distillate stream by distilling the feed gas stream without any specific pretreatment for mercaptans removal (Abstract).

De la Vega does not teach or suggest the use of a gas scrubber to remove mercaptans by contacting the mercaptans with an aqueous alkaline washing solution in the gas scrubber. Instead, De la Vega teaches removing mercaptans from the raw natural gas by distillation. The removal of mercaptans from the raw natural gas is accomplished in scrub column 14 in Fig.1 of de la Vega which is a conventional distillation type column having 5 to 8 or more trays. The mercaptans are removed from scrub column 14 as a mercaptan-rich bottom stream comprising much of the C₂ and heavier components via line 28 (See col. 3, lines 29-55).

Thus, scrub column 14 is not a scrub column “for contacting the gaseous hydrocarbon stream with an aqueous alkaline washing liquid” as required by present claim 9. The removal of mercaptans in column 14 in De la Vega is accomplished by distillation, not by contact with an aqueous alkaline wash solution. Moreover, De la Vega employs a single scrub column, while the gas treating unit claimed in present claim 9 requires at least two gas scrubbers for contacting the gaseous hydrocarbon stream with an aqueous alkaline washing liquid.

The LaFoy Reference

LaFoy discloses an improved process for removing mercaptans from a hydrocarbon stream such as hydrocarbon distillates and sour gasoline by contacting the hydrocarbon stream with an alkaline solution in which mercaptides are soluble (col. 1, lines 4-11 and col. 2, lines 28-33). The removal of mercaptans is accomplished in liquid mercaptan extraction column 4 (See Fig. 1 and col.3, lines 42-50). Even if liquid mercaptan extraction column 4 in LaFoy was

somehow considered to be a gas scrubber, LaFoy still only utilizes a single liquid mercaptan extraction column for this purpose, and therefore does not meet the “at least two gas scrubbers” limitation of present claim 9.

Since none of the cited references teaches or suggests a gas treating unit having at least two gas scrubbers for contacting a gaseous hydrocarbon stream with an aqueous alkaline washing liquid, present claim 9 is clearly patentable over these references. Present claim 10, which depends from claim 9, and therefore contains all the limitations of claim 9, is likewise patentable over these references.

The rejection of claim 5 under 35 U.S.C. § 103 (a) as being unpatentable over Buisman (US 5,354,545) in view of Fernandez de la Vega et al (US 5,659,109) and LaFoy (US 4,562,300), further view of Momont et al (US 5,2988,174), is respectfully traversed.

Claim 5 depends from amended claim 1, and is believed to be patentable for the same reason as discussed above in connection with amended claim 1 (i.e., none of the references, including newly cited Momont et al, teach or suggest contacting a H₂S and mercaptan-containing gaseous hydrocarbon stream with a first buffered aqueous alkaline washing liquid in a H₂S-removal zone to remove H₂S, followed by contacting the H₂S-depleted gaseous hydrocarbon stream with a second alkaline washing solution in a mercaptan-removal zone to remove mercaptans, wherein the pH of the aqueous alkaline washing liquid in the mercaptan-removal zone is higher than the pH of the aqueous washing liquid in the H₂S-removal zone.

Comment on Examiner’s Response to the Applicant’s Arguments Filed 02/11/09

In their previous response Applicant pointed out that the purified gas leaving scrubber 2 in Buisman had a H₂S concentration of 150 ppm, which was an order of magnitude greater than the 10 ppmv H₂S level achieved by Applicant’s process. The Examiner found this argument unpersuasive and respectfully suggested that Applicant “provide evidence or reasonable correlation to prove 150 ppm of H₂S is not within the range of 10 ppmv or less H₂S” recited in Applicant’s claims.

The “150 ppm” concentration for H₂S is presented in TABLE A in column 6 of Buisman, together with the concentrations for CH₄ (79%) and CO₂ (24%) in the purified gas (stream 3) leaving at the top of scrubber 2 in Fig.1. The Buisman reference does not disclose whether the concentrations of CH₄, CO₂ and H₂S in stream 3 are by volume or by weight. Typically, concentrations of components of gas streams (e.g., streams 1 and 3 in Fig. 1 of Buisman) are expressed by volume, while concentrations of components in liquid solution (e.g., the sulphide

concentration in washing liquid stream 10 in Fig.1) are expressed by weight. Thus, absent any disclosure in Buisman to the contrary, it is reasonable to assume that the 79% CH₄, the 24% CO₂ and the 150ppm H₂S in the purified gas stream 3 are all volume measurements. Thus, it is highly likely and reasonable to assume that the 150 ppm of H₂S in the purified gas is in fact 150 “ppm_v” and not “ppm_w” as proposed in the Office action. There is no disclosure in Buisman to support that “150 ppm” means 150 ppm “by weight”, or that “the density of purified gas effluent from the scrubber would be in the magnitude of 0.01 g/cm³” as stated in the Office action. In view of the high probability that the “150 ppm H₂S” in the purified gas is a volume measurement, and in the absence of any disclosure in Buisman to the contrary, Applicant’s argument that the presently claimed process achieves an order of magnitude greater H₂S removal than Buisman (10ppm vs. the 150ppm) is believed supported by the evidence or reasonable correlation. Therefore, Applicant’s argument should have been given greater consideration and found persuasive.

In any case, the claim 1 has been amended incorporate subject matter found to be allowable over the prior art. Therefore, claim 1 and all the claims that directly or indirectly depend therefrom, including claim 5, are believed to be patentable, as are claims 9 and 10 for the reasons discussed above.

Conclusion

For all of the above reasons, the claims remaining in the application (claim 1, as amended, and claims 3-11) are believed to be patentable over the cited references and in condition for allowance. Accordingly, reconsideration and prompt favorable action on the application is respectfully requested.

Respectfully submitted,

WIEBE S. KIJLSTRA, JOSEPHUS N. J. J. LAMMERS
and CLAS I. WERNERSSON

By /Charles W. Stewart/
Their Attorneys, Charles W. Stewart
and Leonard P. Miller
Registration No. 34,023 and 26,004
(713) 241-0360

P. O. Box 2463
Houston, Texas 77252-2463